AMENDMENTS TO THE CLAIMS

1. (Original) A parametric audio generator comprising:

(a) an ultrasonic signal source providing a carrier;

(b) a source of audio signals;

(c) means for modulating the carrier with the audio signals, the frequency of the carrier being sufficiently high that all of the components of the modulated carrier have frequency above the range in which the human auditory system responds;

(d) an ultrasonic transducer for radiating ultrasonic signals; and

(e) means for applying the modulated carrier to the transducer.

2. (Original) The generator defined in claim 1 wherein:

(a) the transducer is a capacitive transducer having a mechanical resonance frequency; and

(b) including means for driving the transducer, said driving means including an inductor coupled with the transducer capacitance to provide an electrical resonance corresponding with the mechanical resonance of the transducer.

3. (Original) A parametric audio generator comprising:

(a) an ultrasonic signal source providing an ultrasonic carrier;

(b) first and second ultrasonic transducers, said first transducer having a first acoustical-mechanical resonance and said second transducer having a second acoustical-mechanical resonance at a frequency higher than that of said first transducer;

(c) a source of audio signals;

(d) means for modulating said carrier with the audio signals, whereby the frequency spectrum of the modulated carrier includes both of said transducer resonances; and

(e) means for driving said transducer with the modulated carrier.

4. (Original) The generator defined in claim 3 including:

(a) an ultrasonic signal source providing an ultrasonic carrier;

(b) first and second ultrasonic transducers, said first transducer having a first acoustical-mechanical resonance and said second transducer having a second acoustical-mechanical resonance at a frequency higher than that of said first transducer;

(c) a source of audio signals;

(d) means for modulating said carrier with the audio signals, whereby the frequency spectrum of the modulated carrier includes both of said transducer resonances;

(e) means for splitting the modulated carrier into upper and lower frequency-range signals;

(f) means for driving said first transducer with said lower frequency range signal; and

(g) means for driving said second transducer with said upper frequency range signal.

5. (Original) The generator defined in claim 3 wherein the frequency of said carrier is sufficiently high that the lowest frequency component in the ultrasonic energy radiated by the transducers is above the range in which the human hearing mechanism responds

6. (Currently Amended) The audio generator of claim 4 wherein:

(a) each of said transducers has an electrically ~~capacitative~~ capacitive element to which the signal for that transducer is applied; and

(b) each of said driving means includes an inductor conducted to resonate with the capacitative element of the transducer driven by the driving means, thereby to provide an electrical resonance corresponding with the acoustical-mechanical resonance of the transducer.

7. (Cancelled)

8. (Cancelled)

9. (Cancelled)

10. (Withdrawn) A parametric audio system comprising:

(a) a parametric audio generator transmitting an audio-modulated ultrasonic beam into an enclosed atmosphere; and

(b) aan environmental-control apparatus for controlling at least one of temperature and moisture content of the atmosphere in the path of said beam, thereby to increase the efficiency of demodulation of the audio signal.

11. (Withdrawn) A parametric audio system comprising:

(a) a plurality of parametric audio generators transmitting steerable audio-modulated ultrasonic beams: and

(b) means for steering said beams to provide an atmospheric volume in which the beams intersect, the combined intensity of the beams in said volume providing a demodulated audio signal having a substantially greater level than the level provided by demodulation of a single one of said beams.

12. (Withdrawn) A parametric audio generator comprising:

(a) an ultrasonic carrier generator;

(b) a modulator for modulating the output of the carrier generator with an audio signal;

(c) a transducer for receiving the modulated output of the carrier generator and in response thereto, transmitting a modulated acoustical beam of sufficient intensity to provide atmospheric demodulation the audio signals contained therein;

(d) a source of audio signals;

(e) a preprocessor for conditioning the output of the source to compensate for cross-modulation of audio components in the acoustical beam; and

(f) means for combining output of said audio signal source with the output of said preprocessor and applying the resulting combined audio signal to said modulator.

13. (Withdrawn) A parametric audio generator comprising:

(a) a carrier generator providing an electrical carrier comprising an ultrasonic frequency;

(b) a modulator for modulating the carrier with an audio signal;

(c) a transducer for receiving the modulated carrier and, in response thereto, transmitting a modulated acoustical beam;

(d) a source of input audio signals;

(e) means for applying the input audio signals to said modulator; and

(f) a signal control unit comprising:

(1) a level sensor sensing the audio signal level from said audio source; and

(2) means for controlling the intensity of the carrier in response to the sensed audio signal level.

14. (Withdrawn) A parametric audio generator comprising:

(a) a carrier generator providing an electrical carrier and an ultrasonic frequency and having an amplitude $\sin(\omega_c t)$;

(b) a modulator for modulating the carrier with an input audio signal $\left(1+\iint g(t)dt\right)$;

(c) a transducer for receiving the modulated carrier and, in response thereto, transmitting a modulated acoustical beam;

(d) a source of input audio signals;

(e) an ultrasonic transducer for radiating ultrasonic signals;

(f) a level sensor for providing a level signal, L(t), corresponding to the level of the input audio signals; and

(f) control means responsive to the input audio signals and the level signal for modulating the electrical carrier to provide a modulated signal, p'(t), of the form

$$p'(t)=P_1\left(L(t)+m\iint g(t)dt^2\right)^{1/2}\sin(\omega_c t),$$

where m is the modulation depth.

15. (Withdrawn) The generator defining claim 14 including:

(a) means for summing the level signal, L(t), with the input audio signals to provide a sum signal;

(b) means for deriving the square root of the sum signal to provide a square root signal; and

(c) means for multiplying the electrical carrier by the square root to provide the modulated carrier.

16. (Withdrawn) The generator of claim 14 wherein the control means includes means for controlling the depth of modulation of the carrier in response to the sensed audio signal level.

17. (Withdrawn) The generator of claim 14 wherein the level sensor has an essentially zero time constant for increases in $g(t)$ peak and a long time constant for decreases in $g(t)$ peak.

18. (Withdrawn) The generator of claim 14 wherein the input signals have an input level and the modulated signal has an output level, and the further comprising means for adjusting the output level according to the input level.

19. (Withdrawn) A display system comprising:

(a) a light-reflecting surface;

(b) a projector for projecting a moving optical image onto said reflecting surface;

(c) a steerable parametric audio generator for transmitting an audio-modulated ultrasonic beam; and

(d) means for steering said audio generator to transmit the ultrasonic beam onto said screen at the location of said optical image, whereby the audio signals demodulated from the ultrasonic beam emanates from the location of the optical image.

20. (Withdrawn) The display system of claim 19 wherein the light-reflecting surface absorbs ultrasonic energy and reflects audio energy.

21. (Withdrawn) The display system of claim 19 wherein the light-reflecting surface diffusely reflects ultrasonic energy.

22. (Withdrawn) A parametric audio generator comprising:

(a) an ultrasonic signal source providing a carrier;

(b) a source of audio signals;

(c) means for modulating the carrier with the audio signals;

(d) an ultrasonic transducer for radiating ultrasonic signals;

(e) means for applying the modulated carrier to the transducer; and

(f) means for compensating for distortion arising from atmospheric propagation and absorption of the radiated ultrasonic signals.

23. (Withdrawn) The generator of claim 22 wherein the compensating means is an ultrasonic equalizer applying compensation based on at least one of (a) an assumed distance, (b) airborne humidity level, (c) temperature, and (d) an amplitude of the modulated carrier.

24. (Withdrawn) The generator of claim 23 further comprising means for determining a distance to a listener, the compensating means being responsive to the distance-determining means and determining a compensation level based thereon.

25. (Withdrawn) The generator of claim 23 further comprising means for sensing at least one of temperature and airborne humidity.

26. (Withdrawn) A parametric audio generator comprising:

(a) an ultrasonic signal source providing a carrier;

(b) a source of audio signals;

(c) means for modulating the carrier with the audio signals;

(d) an ultrasonic transducer for radiating ultrasonic signals at an output level;

(e) means for applying the modulated carrier to the transducer; and

(f) means for controlling the output of the transducer to avoid subjecting listeners to unsafe output levels.

27. (Withdrawn) The generator of claim 26 wherein the means for preventing subjection of listeners to unsafe output levels comprises:

(a) means for determining a distance between the transducer and a listener; and

(b) means for controlling the output level based on the sensed distance.

28. (Original) A method of selectively transmitting audio signals to a selected location, the method comprising the steps of:

(a) modulating an ultrasonic carrier with at least one audio signal, the frequency of the carrier being sufficiently high that all of the components of the modulated carrier have frequencies above the range in which the human auditory system responds; and

(b) directing a beam containing the modulated carrier toward the location, whereby the audio signal appears to emanate therefrom or is confined thereto.

29. (Original) The method of claim 28 wherein the carrier is generated by at least one capacitive ultrasonic transducer having a mechanical resonance frequency, and further comprising the step of driving the at least one transducer with a driver including an inductor coupled with the transducer capacitance to provide an electrical resonance corresponding to the mechanical resonance of the transducer.

30. (Currently Amended) The method of claim 28 wherein the location is a moving location associated with an apparent source ~~has a moving location~~, and further comprising the steps of:

(a) tracking the location of the apparent source; and

(b) responsively directing the beam toward the moving location.

31. (Original) The method of claim 30 further comprising the step of continuously directing at least one visual image onto the moving location such that the audio signal appears to emanate from the at least one visual image.

32. (Original) The method of claim 28 further comprising the step of utilizing, as an apparent source, a surface that absorbs or diffusively reflects ultrasonic energy and reflects audio energy, thereby creating a relatively non-directional source of audio signals from the apparent source.

33. (Original) The method of claim 28 further comprising the steps of:

(a) utilizing, as an apparent source, a surface that specularly or diffusively reflects audio energy; and

(b) steering the apparent source to guide the reflected audio to a desired area.

34. (Withdrawn) A method of selectively transmitting audio signals to a selected location, the method comprising the steps of:

(a) modulating an ultrasonic carrier with at least one audio signal;

(b) directing a beam comparing the modulated carrier toward the location, whereby the audio signal appears to emanate therefrom or is confined thereto; and

(c) controlling at least one atmospheric condition proximate to the location to increase demodulation efficiency.

35. (Withdrawn) The method of claim 34 wherein at least one of temperature and moisture level is controlled.

36. (Withdrawn) The method of claim 34 wherein a fine particulate agent is introduced in proximity to the apparent source or a transducer generating the beam.

37. (Original) A method of selectively transmitting audio signals to a selected location, the method comprising the steps of:

(a) modulating an ultrasonic carrier with at least one audio signal;

(b) directing a beam comparing the modulated carrier toward the location, whereby the audio signal appears to emanate therefrom or is confined thereto;

(c) providing a loudspeaker; and

(d) causing the loudspeaker to reproduce low-frequency components of the audio signal.

38. (Original) The method of claim 28 wherein the carrier has an audible amplitude and further comprising the step of adjusting the audible amplitude to maintain a modulation depth near a desired level.

39. (Currently Amended) The method of claim ~~28~~ 38 wherein the desired level is unity.

40. (Original) The method of claim 28 further comprising the step of at least reducing transmission of the carrier in response to amplitude reduction of the audio signal.

41. (Withdrawn) A method of transmitting audio signals, the method comprising the steps of:

(a) modulating an ultrasonic carrier signal with audio signals;

(b) radiating the modulated carrier as ultrasonic signals at an output level; and

(c) compensating for distortion arising from atmospheric propagation of the radiated ultrasonic signals.

42. (Withdrawn) The method of claim 41 wherein the compensation is based on at least one of (a) an assumed distance, (b) airborne humidity level, and (c) an amplitude of the modulated carrier.

43. (Withdrawn) The method of claim 41 further comprising the step of determining a distance to a listener, compensation being based on the determined distance.

44. (Withdrawn) A method of transmitting audio signals, the method comprising the steps of:

(a) modulating an ultrasonic carrier signal with audio signals;

(b) radiating the modulated carrier as ultrasonic signals at an output level; and

(c) controlling ultrasonic signals to as to avoid subjecting listeners to unsafe output levels.

45. (Withdrawn) The method of claim 44 wherein the step for preventing subjection of listeners to unsafe output levels comprises:

(a) determining a distance between the transducer and a listener; and

(b) controlling the output level based on the sensed distance.

46. (Withdrawn) A method of selectively transmitting audio signals to an acoustically isolated region, the method comprising the steps of:

(a) modulating each of a plurality of ultrasonic carriers with at least one audio signal, the frequency of the carriers being sufficiently high that all of the components of the modulated carrier have frequencies above the range in which the human auditory system responds; and

(b) directing the modulated carriers so as to intersect in a selected region, the carriers having a combined intensity within the selected region such as to provide a demodulated audio signal having a substantially greater level than the audio level provided by demodulation of a single one of the modulated carriers, whereby the audio signal emanates from the selected region.

47. (Withdrawn) The method of claim 46 further comprising the step of moving the region by shifting the modulated carriers to intersect at a desired location.

48. (New) The generator defined in claim 2, wherein the capacitive transducer is a film-based transducer.

49. (New) The method of claim 28, wherein the amplitude level of the modulated ultrasonic carrier is adjusted in response to a change in the audio signal.

50. (New) The method of claim 49, wherein the adjustment to the modulated ultrasonic carrier is temporally asymmetric with the change in the audio signal.